of *Habenaria dilatata*. Still later comes *Spiranthes Romanzoffiana*. The occurrence of this last species is especially noteworthy as being one of the extreme southern stations of this plant in New England, only a few miles from the Massachusetts line. In the higher portions of these swamps *Cypripedium acaule* grows abundantly.

Possibly a further examination of these places will yield one or two more species of Orchids. At any rate the locality is one of great interest not merely to the Orchidologist, but particularly to the student of the *Cyperaceae* and in fact to the plant-enthusiast generally.

CRITICAL NOTES ON THE NEW ENGLAND SPECIES OF LAMINARIA.

William Albert Setchell.

The species of the genus Laminaria have been much studied, especially on the western and northern shores of Europe, and much has been done to reduce the numerous and puzzling forms within certain and recognizable specific limits. While this has been fairly well accomplished for the European species, those of the rest of the world are still in need of more study in the laboratory and the field. Particularly is this true for the forms inhabiting the coast of New England, and the regions adjacent both to the North and to the South. De la Pylaie (1824 and 1829) and Harvey (1852) have given accounts of the species of this general region, and Farlow (1881) has revised, as far as possible, these older accounts, and incorporated the additional knowledge up to that time. Farlow states, however, that he must necessarily be content "with a superficial account of the perplexing forms of this exasperating genus," since he was unable to make use of the notes furnished him on the American forms by European correspondents. Since then, however, the Scandinavian algologists have worked over their species very carefully, and Foslie, in particular, has published (1884) a detailed and illustrated account of the Norwegian species. The writer intends to follow this account rather closely in the notes on the New England species given below.

The writer began his study of the *Laminariæ* in the fall of 1887, while a graduate student at Harvard University, the topic being suggested to him by Professor Farlow. From that time until the fall of 1895, this with other topics among the *Laminariaceæ*, continued to

interest him. Since the latter date, however, he has been unable to study the species in the field and it has seemed best to place before those who may have this opportunity, the results of this work, although incomplete, in the form of notes and suggestions. The papers of Farlow (1881) and Foslie (1884) will serve as a basis for the discussion of the New England forms, while frequent reference will be made to the articles of Guignard (1892) and various statements of Kjellman with regard to this group.

The species of the genus Laminaria are first divided into two groups by most writers, according to the character of the blade. In one section, the *Digitatæ*, the blade is more or less broad and split longitudinally into segments; while in the other section, the *Simplices*, the blade is proportionally narrow, and normally entire. These characters are usually very marked and there is little difficulty in the case of a perfect specimen, in deciding to which of these sections it belongs. Occasionally, a digitate form persists to the time of fruiting, with an undivided blade; but in such a case, the section is made clear by the breadth and shape of the blade. In other cases, the simple forms may be split longitudinally, but this does not obscure the relationship, since the specimen, if otherwise at all perfect, shows by the proportions of the blade, that it does not belong to the digitate section.

Within each of the two main groups, the species are divided under sub-groups, according to the presence or absence of mucilage ducts in stipe or blade, or both. While there are certain conflicting statements in regard to the constancy of these latter characters in certain given species, it seems probable that these arise from the imperfect character of the investigations hitherto made, and that when all the various species have been thoroughly and carefully investigated, these contradictory statements will disappear. More study of the fresh material is needed for this, and students of this genus on the coasts of New England may, by careful attention to this matter, help greatly. Certain species have mucilage ducts in the stipe and certain others do not, the same being true for the blade. The subgroups, then, are as follows: 1. Mucilage ducts present in both stipe and blade; 2. Mucilage ducts present in the blade but not in the stipe; 3. Mucilage ducts absent from both stipe and blade. The paper of Guignard (1892) should be consulted for details concerning the structure and course of the mucilage ducts, as well as for a resumé of the distribu-

tion of these structures in the various genera and species of the *Laminariaceæ*.

The final marks for distinguishing the species under each of these groups are varied, including arrangement of hapteres, character of stipe, shape of the base of the blade, presence or absence of an intramarginal series of alternate depressions and elevations, presence or absence of a ruffled margin, position, shape, etc., of the sori, the length of duration of the plant and the method of the renewing of the blade. That some of these characters are of little value for specific criteria, seems evident to the writer and a few words in regard to each of them may help toward a clearer understanding of these matters.

The arrangement of the hapteres, the branching outgrowths from the lower part of the stipe, fixing the plant to the substratum, varies very decidedly in the same species according to the particular habitat and substratum. The tendency toward a whorled arrangement is the normal one for all the species, but in many of them it is very much disturbed, and only makes its appearance under exceptionally favorable circumstances. The degree and regularity of the branching of the hapteres, too, is very variable and dependent upon the environment.

The character of the stipe often affords excellent means for distinguishing the species of one or other of the smaller groups. *L. longicruris* is readily to be distinguished from all other species by its hollow stipe; the stout and much flattened stipe of the forms of *L. digitata* serves to distinguish this species from others of the digitate section; and while the length of the stipe is variable in all the species, the proportions existing between the length of the stipe and the length of the blade are often a great help in distinguishing between the forms.

The shape of the blade, particularly of the basal portion, while often very variable in the same species, is yet a very satisfactory character in subdividing a species into its forms.

The ruffles along the edges of the blade of the species of the *Simplices* group, have been used, in connection with the rows of alternate elevations and depressions within the ruffles, in distinguishing species and more often in distinguishing between the different forms or varieties of the same species, but this is a very uncertain character, since, in some species, at any rate, the presence or absence of these characters depends on the season. In *L. Agardhii* and in *L. saccharina* of the

New England coast, the writer has found that the summer form is usually ample, with ruffles and rows of indentations fully developed; but in August a change takes place and this summer blade is replaced by a winter blade which is perfectly plane and devoid of both of these features. Again, in the spring, this plane blade is replaced by the ruffled and indented form, and it is possible, accordingly, to find at these seasons fronds which show blades of both kinds in varying proportions. This seems to be a sort of seasonal dimorphism.

The duration of the species of Laminaria has never been carefully investigated; it probably varies very much among the species of the genus. *L. longicruris* is credited with being an annual plant, while *L. saccharina* is biennial at least, and is probably perennial. *L. digitata* is certainly perennial and has rings in the lower portion of the stipe which are probably rings of growth. *L. stenophylla* and *L. intermedia* seem to be the annuals among our digitate *Laminariæ*, while *L. platymeris* is certainly perennial.

The perennial species all show the phenomenon of the renewing of the blade, due to a cessation of the growth during the latter part of the winter, the thickening of the tissues of the blade and usually the formation of sori. In the spring, the active intercalary growth is resumed by the inner tissues. The result is that the old thick, fruited blade is carried up on the summit of the new thin, as yet usually sterile blade, and the constriction between the two as well as the difference in texture between the two blades, makes this a very striking phenomenon in the majority of species. The digitate forms with mucilage glands in the stipe show the renewal in a much more striking fashion than do the digitate species without the ducts in the stipe, as Foslie (1884, pp. 26–28 and pl. 1, f. 1, pl. 3, f. 4, pl. 4, f. 1, pl. 5, f. 1, 2, pl. 10, f. 3–10), has shown. A similar difference exists in the cases of *L. digitata* and *L. platymeris* of the New England coast. In the perennial (or biennial?) form of the *Simplices* group, the renewing of the blade in the spring is equally pronounced, the plane thick blade of the winter being replaced by the thin, ample, ruffled, and indented blade of the spring and summer. In these forms, an almost equally pronounced renewing takes place in the early or later autumn, as mentioned above, when the thick, ruffled, indented and often fruited blade of the summer is replaced by the fairly thick plane blade of the early winter. The renewing at these seasons is found even in young specimens (cf. Foslie, loc. cit., pl. 10, f. 3-10).

Many cases of distortion of the species of Laminaria and of other species of the *Laminariaceæ*, are to be met with in any extensive collecting. Spiral forms both of blade and of stipe are often found, as well as the trilaminate forms, both of the digitate and of the simple species. Bifurcate forms are rarer, but do occur in the digitate species. They arise from the blade being split deeper than usual, that is even down through the transition place into the stipe, while the plant is still young and the tissues are still capable of a considerable amount of growth. These forms have even received varietal names from the earlier algologists.

(*To be continued.*)

NOTES ON THE DISTRIBUTION OF SOME OF THE RARER PLANTS OF CENTRAL MASSACHUSETTS.

Roland M. Harper.

During two seasons of botanizing in Worcester County and adjacent territory, I have met with quite a number of plants which, while already known to occur in the counties or states in which I collected them, are perhaps so local in their distribution that new stations for them may be of more or less interest to any one who makes a study of the geographical and altitudinal distribution of the flora of New England.

Most of these plants have hitherto been known in Worcester County from only one town, or have been reported by only one observer; and an examination of the more recent local floras of adjacent states and counties has shown me that they are, for the most part, little known in those regions also. I have therefore thought it worth while to place on record some of my observations on a few such plants for comparison with those of other botanists.

The lists of stations here given may be regarded rather as tending to fill lacunæ in our present knowledge of the distribution of the plants under consideration, than as furnishing actual extensions of range. All the plants mentioned have been collected in 1899 unless otherwise specified.

Botrychium matricariæfolium, Braun. Rich damp woods, Southbridge, August 13, 1898 (altitude 520 feet); only two or three specimens seen. This seems to be the southernmost known station for